

ILLINOIS WATERWAY, THOMAS J. O'BRIEN LOCK AND
CONTROL WORKS
East 130th Street
Chicago
Cook
Illinois

HAER IL-164-I
IL-164-I

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

HISTORIC AMERICAN ENGINEERING RECORD

ILLINOIS WATERWAY, THOMAS J. O'BRIEN LOCK AND CONTROL WORKS

HAER No. IL-164-I

Location: East 130th Street, Chicago, Cook County, Illinois, on the Calumet River
Latitude: 41.652819, Longitude: -87.568536

Present Owner: U.S. Army Corps of Engineers

Present Use: Navigation of Illinois Waterway

Significance: The Thomas J. O'Brien Lock and Control Works is significant as a component of the Illinois Waterway, a navigable route linking Lake Michigan with the Mississippi River and beyond. The lock and control works are located on the Calumet-Sag Channel, an artificial channel that connects the Little Calumet River with the Chicago Sanitary and Ship Canal. The Army Corps designed the Thomas J. O'Brien lock (in operation in 1965) to accommodate the longer barge tow configurations in use on the waterway. The lock is significant for its use of sector gates as the Army Corps experimented with a new gate type to reduce construction costs and accommodate the particular conditions at the site.

Historian: Justine Christianson, HAER Historian, 2008

Project Information: The Illinois Waterway Recording Project (2007-2008) is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. HAER is administered by the Heritage Documentation Programs, a division of the National Park Service, U.S. Department of the Interior, Richard O'Connor, Manager. The U.S. Army Corps of Engineers (USACE) funded the project. Ron Deiss, USACE, and Dana Lockett, HAER Architect, served as project managers. Dana Lockett and Anne Kidd produced the measured drawings. Large format photography was done by Brian Grogan. Justine Christianson wrote the historical reports. Research assistance was provided by John Fitzgerald, Archivist, USACE.

Part I. Historical Information

A. Physical History:

1. Date of Construction: (1957-60)

The lock, control works, control station, and control stands were built from 1957-60 and put into operation in 1965.¹

2. Architect/Engineer:

G.F. Brown, of the U.S. Army Corps of Engineers, Chicago District, designed the lock, control works, control station, and control stands.²

3. Builder/Contractor/Supplier

Fitz Simons & Connell Dredge & Dock Company, a division of Merritt-Chapman & Scott Corporation, built the lock.³

4. Original Plans:

A drawing of the L-shaped control station (designated "Lock Powerhouse") from 1957 reveals the layout of the building as constructed. A paint storage room is indicated at the upstream end, followed by a standby engine room, switchgear room, machine shop, locker room, and toilets at the downstream corner, with a storeroom and room labeled "lock master" extending towards the lock.⁴

B. Historical Context:

A 1910 report noted that the south end of the Calumet River was "simply intolerable" and warned that a typhoid epidemic or other "diarrheal diseases among the 500,000 people using water from the Sixty-Eight Street intake" could occur. Arthur Lederer, Chemist and Bacteriologist, stated that a study of the water at the south end of Lake Michigan "shows the water to be grossly polluted and unfit for drinking purposes" because of the sewage and manufacturing wastes being dumped into it from the Calumet River.⁵

¹ Mary Yeater Rathburn, American Resources Group, Ltd., "Architectural and Engineering Resources of the Illinois Waterway between 130th Street in Chicago and La Grange," Volume 2, prepared for the U.S. Army Corps of Engineers, Rock Island District, Rock Island, Illinois, October 1996, pp. 7-8, 11-24.

² Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 7-8, 11-18, 21-24.

³ "Light Cofferdam Cuts Lock Cost," *Construction Methods and Equipment* 41, no. 6 (June 1959): pp. 109-113.

Staff from Fitz Simons & Connell included Herbert L. Taylor, Construction Manager; Fred Hazard, Project Manager; F.L. Van Sickle, Superintendent. From the U.S. Army Corps, L.S. Kreger served as the Resident Engineer for the Cal-Sag Project while R.R. Ramsdell served as Project Engineer at the lock (see p. 113).

⁴ "Calumet-Sag Navigation Project, Calumet River Lock & Controlling Works, Lock Powerhouse, Plumbing & Drainage," November 15, 1957, available from U.S. Army Corps of Engineers, Rock Island District.

⁵ "Report of the Committee on Engineering of the Sanitary District of Chicago, Recommending the Immediate Construction of the Calumet-Sag Channel for the Protection of the Water Supply of the People of the Calumet District from Contamination by Sewage," adopted by the Board of Trustees, May 25, 1910 in Committee on Engineering, Sanitary District of Chicago, "Calumet-Sag Canal, A Vital Necessity," (May 25, 1910), p. 12.

The increasingly polluted waters resulted from the growing population of the Calumet District as well as the rising number of manufacturing plants in the Calumet District and northern Indiana that discharged industrial waste into the river.⁶ Isham Randolph, Chief Engineer of the Sanitary District of Chicago, advocated a building project similar to that on the Chicago River in which the flow of the Calumet River would be diverted from emptying into Lake Michigan. The project would entail creating a new sanitary canal that would also divert water from Lake Michigan through the Little Calumet and Calumet rivers and empty into the Chicago Sanitary and Ship Canal. The diversion of water and reversal of flow would help dilute sewage and prevent it from entering Lake Michigan, which served as the city's source of drinking water. The new canal would connect with the Chicago Sanitary and Ship Canal at a point southwest of the Chicago Portage. Randolph argued that the construction of such a channel was required to protect Chicago's water supply and that delay "caused by the refusal of the federal authorities to issue the necessary permit under which water may be taken from Lake Michigan, has worked a hardship upon the citizens of Chicago and the State of Illinois."⁷ The plans came to fruition with the construction of the Calumet-Saganashkee Channel (also known as the Calumet-Sag or the even more shortened form of Cal-Sag) from 1911 to 1922 by the Sanitary District of Chicago.⁸ The 16.2 mile long channel extended from the Little Calumet River at Blue Island to the Chicago Sanitary and Ship Canal and measured 20' deep and from 36' to 60' wide when completed.⁹

Soon after the completion of the Cal-Sag, local interests began lobbying to improve it in an effort to promote "efficient and economical modern barge service" along the channel. The impetus to improve the Calumet waterways stemmed from the impending completion of the Illinois Waterway by the Army Corps and a desire to take advantage of the new navigable route to the Mississippi River and beyond. The size of the Cal-Sag did not allow the industries of the Calumet region (such as Hammond, East Chicago, and Gary) direct access to the waterway, nor could it accommodate the larger vessels plying the Illinois Waterway.¹⁰ While the Chicago

⁶ "Report of the Committee on Engineering of the Sanitary District of Chicago," pp. 4-5.

⁷ "Report of the Committee on Engineering of the Sanitary District of Chicago," pp. 7-8.

⁸ The western end of the channel is near Saganashkee Slough.

⁹ "Preliminary Examination and Survey of Calumet-Sag Channel, ILL" from Chief of Engineers, U.S. Army Corps of Engineers, December 1933, in U.S. Army Corps of Engineers, "Calumet-Sag Channel, IL," (Washington, DC: U.S. Government Printing Office, 1934), p. 2; National Rivers and Harbors Congress, Projects Committee, February 1940, Application made to Fred D. Beneke, Secretary, National Rivers and Harbors Congress, Washington, DC for examination and recommendations by Projects Committee for Calumet-Sag Channel, Illinois and Indiana Harbor and Canal, Indiana, in Folder 800.921, Cal Sag Channel, Cal R, L Cal R, Lake Cal, File #5, in U.S. Army Corps of Engineers, Chicago District, Record Group 77, National Archives and Records Administration, Great Lakes Region-Chicago (hereafter cited as RG 77, NARA, Chicago); W.G. Gude, "Illinois Waterway is Now Completed: Final Link in Lakes to Gulf System," *Marine Review* 63, no. 6 (June 1933): p. 20.

¹⁰ "Proposed Improvement of the Grand Calumet River in Illinois and Indiana," Memorandum by the Chicago Regional Planning Association, Burnham Building, Chicago, September 1930, p. 2, in Folder 800.921, Cal Sag-Channel, Cal R, L Cal R, Cal R & Lake Cal, File #1, in U.S. Army Corps of Engineers, Chicago District, RG 77, NARA, Chicago.

River with its 160' width was a feasible shipping route, it passed through Chicago and was consequently congested.¹¹

The River and Harbor Act of July 3, 1930 approved the survey of the Calumet and Little Calumet rivers, Lake Calumet, and the Calumet-Sag Channel "with a view to providing a connection with, and terminal transfer harbors for, the waterway from Chicago to the Mississippi River."¹² A report by the Army Corps in 1933 detailed the proposed improvements to the Calumet-Sag Channel, which included dredging to a 9' depth and 250' width in the channel sections and a 300' width in the sections traversing the Little Calumet and Calumet rivers. A new 110' x 600' lock would be constructed to replace the 50' x 350' lock in place at the eastern end of the channel. The estimated cost of the improvements and dredging was \$21,525,750.¹³

Another improvement project was proposed for the channel in 1940, which included enlarging the Calumet-Sag Channel from its junction with the Little Calumet River to its junction with the Chicago Sanitary and Ship Canal to a 9' depth and 160' width. The Army Corps would choose sites suitable along the channel for the construction of a lock or multiple locks "to prevent reversals of flow, to maintain the water levels west of the locks at two feet below Chicago city datum, and to regulate diversion." From the junction of the Grand Calumet River with the Little Calumet River to its junction with the Indiana Harbor Canal, a barge canal measuring 9' deep and 160' wide would be dredged. Finally, highway bridges would be rebuilt or altered as necessary to provide adequate clearances.¹⁴

In 1946, Congress finally authorized the improvement of the Calumet-Sag Channel. Planners believed that these improvements would

stimulate water commerce by providing a satisfactory outlet to the lake from the Illinois waterway and the large network of inland waterways connected with it. It is of especially great value because it will serve the most concentrated industrial district in the middle-west, at the southern tip of Lake Michigan near Calumet and Indiana harbors, where are located numerous steel mills, oil refineries, and storage plants, grain elevators, chemical plants and other heavy industries.¹⁵

The Calumet-Sag Channel project consisted of three parts. Part I included improving the Sag Junction (which was the junction of the Calumet-Sag Channel at the Chicago

¹¹ John W. Larson, *Those Army Engineers: A History of the Chicago District U.S. Army Corps of Engineers* (Chicago: U.S. Army Corps of Engineers, Chicago District, 1979), pp. 223, 225.

¹² "Preliminary Examination and Survey and Review of Reports on Calumet-Sag Channel (1931-33)," p. 1, in Folder 800.921, Cal Sag-Channel, Cal R, L Cal R, Lake Cal, File #2, in U.S. Army Corps of Engineers, Chicago District, RG 77, NARA, Chicago.

¹³ "Preliminary Examination and Survey of Calumet-Sag Channel, ILL," pp. 7-10.

¹⁴ Application made to Fred D. Beneke, Secretary, National Rivers and Harbors Congress, Washington DC.

¹⁵ Application made to Fred D. Beneke, Secretary, National Rivers and Harbors Congress. The authorization was included in H Doc 677, 79th Cong, 2d sess, July 24, 1946.

Sanitary and Ship Canal), Calumet-Sag Channel, Little Calumet and Calumet rivers, to Turning Basin No. 5 on the Calumet River at the entrance to Lake Calumet. The work required building a lock, creating a 225' wide channel with a 9' navigable depth, and replacing twelve railroad and eleven highway bridges with inadequate clearances.¹⁶ Part II called for widening the Grand Calumet River from its junction with the Little Calumet River to Clark Street in Gary, Indiana and then creating a link extending north from the Calumet River to the Indiana Harbor Canal (most of which was not navigable at the time), building a lock, and replacing those bridges with inadequate clearances that spanned the route. Part III required widening the Chicago Sanitary and Ship Canal from Lockport to its junction with the Cal-Sag from a bottom width of 160' to 225' and altering those bridges with inadequate clearances that spanned that section of waterway.¹⁷

Construction of the Thomas J. O'Brien Lock and Control Works, which replaced the Blue Island Lock and Control Works located 7 miles upstream, was completed in 1960. The Blue Island Lock was located at the eastern terminus of the Calumet-Sag Channel and measured only 50' x 360'. The Corps held the Thomas J. O'Brien lock and control works (named after Representative O'Brien, a "veteran Democrat from Chicago's 6th district who has been instrumental in pushing much of the Calumet-Sag waterway improvement legislation thru Illinois' inland water way") open until 1965 when the Blue Island site finally closed. The new Thomas J. O'Brien site then went into operation.¹⁸

The sluice gates of the Thomas J. O'Brien control works provided emergency flood relief by "permitting temporary flows thru the lock and dam complex in order to reduce storm water runoff into the two rivers." The gates also regulated the amount of water diverted from Lake Michigan and controlled the water levels landward of the lock.¹⁹ Since fourteen barge tows were then in common use on the waterway, the Thomas J. O'Brien Lock had a 110' x 1000' chamber to accommodate that configuration while still providing enough clearance during lock filling operations.²⁰ Rather than designing the lock with miter gates as had been done elsewhere along the waterway, the Army Corps chose sector gates. As the authors of an article detailing

¹⁶ William J. Santina and E.G. Hoffman, "Calumet River Lock, Calumet-Sag Project, Illinois," *Journal of the Waterways and Harbors Division, Proceedings of the American Society of Civil Engineers*, Paper No. 1642, WW3 (May 1958), p. 1642-2.

¹⁷ John B. Corey, Jr., "Calumet-Sag Navigation Project," *Journal of the Waterways and Harbors Division, Proceedings of the American Society of Civil Engineers* Paper 1643, WW3 (May 1958): pp. 1643-2 – 1643-3.

¹⁸ "500 Dedicate O'Brien Lock and Dam Today," p. 21.

¹⁹ Mary Yeater Rathburn, American Resources Group Ltd., "Architectural and Engineering Resources of the Illinois Waterway between 130th Street in Chicago and La Grange, Illinois," Volume 1, prepared for the U.S. Army Corps of Engineers, Rock Island District, Rock Island, Illinois, October 1996, p. 98; "500 Dedicate O'Brien Lock and Dam Today," *Chicago Daily Tribune*, October 20, 1958, p. 21; Anne Getz, "Reveal Calumet Flood Plan," *Chicago Daily Tribune*, July 10, 1966, p. S1; Santina and Hoffman, "Calumet River Lock," p. 1642-2.

²⁰ Santina and Hoffman, "Calumet River Lock," p. 1642-3. The standard barge tow measured 930' in length, with a 40'-50' clearance as needed to accommodate any turbulence at the upstream end and 20' clearance at the downstream end.

the lock's construction noted, "the gates for the Calumet River Lock are notable since this is the first time, to our knowledge, that sector gates are employed in a lock with a width as great as 110 feet."²¹

Part II. Structural/Design Information

A. General Description:²²

The Thomas J. O'Brien site consists of the lock, control works, control house, and a number of auxiliary structures relating to the operation and maintenance of the lock and control works.

The 93' long reinforced concrete control works stretches across the Calumet River and contains four single-leaf, vertical lift, submergible sluice gates. Each of the gates has its own gate lifting machinery located above the gate it operates. The control works itself is constructed of cellular steel sheet piling. There are nineteen cells (measuring 28' x 26') made of sheet pile, filled with crushed stone and capped with concrete. Sheet pile diaphragms separate the cells. The control section containing the gates is constructed of reinforced concrete on steel bearing piles. Recesses are located on either side of each gate in which bulkheads can be placed if the gate needs to be dewatered for maintenance or repair.²³ On the top of the dam between the dam gates and the lock is a one room, one story metal building dating to the 1960s that houses electrical lines, breakers and other equipment.²⁴

To the west of the control works is the lock, also constructed of eighty-six cells made of sheet pile and filled with crushed stone and capped with a reinforced concrete L-shaped cantilever. Each cell measures 28' x 26' and is separated by sheet pile diaphragms. The river wall measures 23' wide while the landwall measures 28' wide. The chamber is 110' x 1000' long.²⁵ The gate block and sills are reinforced concrete, with the gate blocks consisting of the gate anchorages and a 10' thick floor slab. The gate blocks at the upstream end of the chamber have loop culverts with vertical slide gate valves operated by hoists to control the flow of water. The gate hinges and sill seals were adjustable to accommodate for up to 2" of settlement between the gate block and floor sills.²⁶ Another feature of the lock is the vertical recesses located in the gate blocks above and below each gate. These recesses held the lock bulkheads, consisting of steel units placed in a tier, much like the wood stop logs were used at other points along the waterway. A floating plant could install the bulkheads if

²¹ Santina and Hoffman, "Calumet River Lock," p. 1642-6.

²² Descriptions based on Rathburn and American Resources Group, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 5-34 and fieldwork done by the HAER recording team in 2007 and 2008.

²³ Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 23-24; Santina and Hoffman, "Calumet River Lock," pp. 1642-3 and 1642-10; "Light Cofferdam Cuts Lock Cost," p. 110.

²⁴ Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 33-34.

²⁵ "Light Cofferdam Cuts Lock Cost," p. 110; Santina and Hoffman, "Calumet River Lock," pp. 1642-3 – 1642-4.

²⁶ Santina and Hoffman, "Calumet River Lock," p. 1642-5 and 1642-10.

dewatering the gates was necessary.²⁷ The lock has steel framed sector gates (each of which has a 61' radius), which look like wedges of pie in plan. The curved surface of the gate has a steel skin and faces upstream. It rotates much like a miter gate on a vertical axis consisting of a two-part hinge. In the open position, the sector gate is housed within a recess in the chamber wall. Hydraulic machinery operates the gates and is housed in a pit near the gate it controls.²⁸

Control stands (also known as "dog houses") are located at each corner of the lock chamber adjacent to the lock gates. The four one-room, one-story brick control stands have windows that provide unobstructed views of the chamber and contain the switches necessary to operate the lock gates and valves.²⁹

The control station is centered on the landward side of the chamber and dates to 1960. This rectangular building with a flat roof has a small wing at the east end of the main elevation.³⁰ (See Appendix A, Figure 6) A one story, rectangular brick workshop with a flat roof is located at the rear of the powerhouse and dates to 1981.³¹

To the north of the control station and workshop is a parking lot and comfort station, remnants of a time when the public could visit the site. The 1970s era 414 square foot restroom has scored concrete walls and a gable roof. It contains separate facilities for men and women.³² In the 1970s, a lifeboat crane consisting of two single-armed metal derricks used to load and unload material from the lifeboats was located at each end of the lock's landwall.³³

B. Construction:

The Chicago District of the Army Corps of Engineers designed the lock and control works in 1957. Two years later, the lock and control works were reportedly 44 percent complete at a cost of \$2,645,500. In 1960, the construction was 96 percent complete, although the lock and control works were not put into operation until 1965.³⁴

The Army Corps chose to use sector gates at the lock rather than the miter gates predominantly used elsewhere along the waterway because sector gates could continue operating even in reverse flow conditions, which occur when the channel level was

²⁷ Santina and Hoffman, "Calumet River Lock," p. 1642-9. The recesses and bulkheads were identical to those used at Lock 27 on the Upper Mississippi River.

²⁸ Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 21-22; Santina and Hoffman, "Calumet River Lock," p. 1642-6.

²⁹ Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 11-18.

³⁰ Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 7-8.

³¹ John W. Amillo is credited with designing the workshop. Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 9-10.

³² Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 19-20.

³³ Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 29-30.

³⁴ U.S. Army Corps of Engineers, *Annual Report of the Chief of Engineers* (Washington, DC: Government Printing Office, 1959), p. 1323 and 1960, p. 1320. (Hereafter cited as USACE, *Annual Report*, date of publication.)

above that of Lake Michigan.³⁵ Some Army Corps personnel were concerned about the potential for “undesirable surges in the lock chamber,” which could happen when the sector gates were opened to fill the chamber. While one solution to the problem of turbulence in the chamber was to slowly open the gates during filling, the practice could delay the movement of barges and tows on the waterway. A model of the proposed design was built at the Army Corps’ Waterways Experiment Station in Vicksburg to develop a better solution. Testing revealed that the sector gates, coupled with short bypass culverts in the upstream gate blocks resulted in an “acceptable minimum filling” time that did not create “excessive hawser line stresses for tows” in the chamber. The Army Corps, therefore, incorporated these bypass culverts into the design of the chamber.³⁶

The use of sector gates allowed Army Corps engineers to experiment with less expensive chamber wall construction since the network of tunnels, culverts and valves located within the chamber walls for filling and emptying operations that characterized locks with miter gates was not required. The Army Corps settled on using steel sheet piling for the chamber walls rather than the traditional reinforced concrete, resulting in time and construction cost savings.³⁷

Fitz Simons & Connell Dredge & Dock Division of Merritt-Chapman & Scott Corporation, with the low bid of \$5.8 million to build the lock, won the contract in July 1958.³⁸ Their bid was \$800,000 below that of the next low bidder, in part because of the decision to build a single-wall, sheet-pile cofferdam with batter pile bracing rather than a cellular, earth-filled cofferdam. The use of single sheet piling in cofferdams was common in dock construction in Chicago, so the company applied this technique to lock construction.³⁹

The first month of work at the site consisted of building a 1 mile-long permanent access road and setting up the plant. From August to September 1958, the contractor drove 6,000 tons of piles, 5,000 of which were sheet piling. They also drove 7,100 linear feet of bearing piles and 372,000 square feet of sheet piling for the cells. Work took place at several points simultaneously. Pile driving was done by one of five rigs. Two rigs consisted of floating derrick barges on which 15-ton stiff-leg derricks with either Vulcan or McKiernan-Terry hammers were mounted. There were also two 35’ x 135’ x 9’ scows with Vulcan 50C hammers. Finally, the contractor used a Manitowoc 2000 on the shore to drive the inner sheet piles for the guide walls using a 2,400 pound Conmac hairpin drop hammer.⁴⁰

³⁵ Santina and Hoffman, “Calumet River Lock,” p. 1642-6.

³⁶ Santina and Hoffman, “Calumet River Lock,” p. 1642-7.

³⁷ Santina and Hoffman, “Calumet River Lock,” p. 1642-3; “Light Cofferdam Cuts Lock Cost,” p. 110.

³⁸ “Light Cofferdam Cuts Lock Cost,” pp. 109-110, 113.

³⁹ “Light Cofferdam Cuts Lock Cost,” p. 109.

⁴⁰ “Light Cofferdam Cuts Lock Cost,” pp. 110-112.

Once the wall cells were in place, Fitz Simons & Connell were able to build temporary cofferdams at the lock ends using single sheet piling and batter piles driven in place by a derrick outfitted with a McKierman-Terry 933 hammer. The batter piles were 12H53 sections averaging 50' long, of which 30' were located underground. The piles were then connected by a "continuous horizontal wale" made up of 12H53 beams "set end to end with their webs horizontal." The piles were connected to the wale by a chip angle fashioned from 12H53 beam scraps or Z sheet piling since "no standard angle section was heavy enough for the job." Four stiffener plates were also welded at the connection to prevent twisting and buckling. To make the cofferdam watertight, the interlocking joints were filled with a waterproof compound to keep the water out and to lubricate the piles, making them easier to pull out. The contractor estimated that the cofferdam was erected at a rate of about 20' to 30' per day. Once the cofferdam was up, the area was quickly dewatered using six diesel-powered pumps. Crews stopped leaks with cinders. Eventually, the contractor only needed to use an electric pump that ran intermittently to keep the cofferdam "bone dry."⁴¹

The lock required 30,000 cubic yards of concrete for the gate blocks in which the sector gates (weighing 865 tons each) were located. The concrete came to the site "dry-batched" in 6 cubic yard-capacity trucks rather than being mixed onsite since not enough was needed to justify an on-site plant.⁴² (See Appendix A, Figures 1-5)

C. Operation:

The Illinois Waterway had originally been designed for use by "towboats pushing eight jumbo hopper barges," each of which measured 35' x 195'. The configuration of the eight barge tow with a towboat consisted of two rows of three barges tied together followed by a row of two barges tied together. The towboat pushed the three rows into position in the lock chamber then moved alongside the first row (made up of two barges) during the lockage. The resulting configuration measured 105' x 600', which allowed all the barges to be locked through in one pass since the lock chamber conformed to the Ohio River Standard size of 110' x 600'.

By the 1950s, the fourteen barge tows had become the standard. While the Thomas J. O'Brien lock with its 110' x 1000' chamber could handle this larger tow configuration, the earlier locks could not. The fourteen barge tow measured 105' x 985', requiring that the tow be broken into two, known as "cuts," on the other locks. The first cut was made up of two rows of three barges tied together. The second cut followed the standard configuration used in the eight barge tow. Rathburn describes the locking through process with the fourteen barge tow configuration,

After breaking the tow into these two cuts, the towboat pushed the first cut of barges through the lock, locked through with it, pushed the cut out of the lock,

⁴¹ "Light Cofferdam Cuts Lock Cost," p. 112.

⁴² "Light Cofferdam Cuts Lock Cost," p. 113.

locked back through to get the second cut of barges, pushed it into the lock, moved over into the 'third barge slot' in the last row of the eight-barge configuration, locked through with the second cut, and then reassembled the two cuts into one united configuration and moved back into its pushing position.⁴³

This process was time consuming and caused congestion along the waterway, so the Army Corps installed replacement tow haulage units in the 1970s at all the locks except Thomas J. O'Brien. These units allowed the first cut to be pulled through the lock without the towboat, which remained in its position in the second cut. This minimized some of the time spent locking through. The installation of the new tow haulage units facilitated the use of the seventeen barge tow configuration, measuring 105' x 1118'. In this configuration, the first cut is made up of three rows of three barges. The second cut has two rows of three barges while the last row has two barges and an open slot for the towboat.⁴⁴

From the 1930s to the 1970s, the amount and size of the vessels using the Illinois Waterway increased. In 1934, commercial traffic on the waterway amounted to 104,750 tons and had increased by 1953 to 20 million.⁴⁵ Traffic on the waterway leveled in the 1970s but congestion on both the Illinois Waterway and the Upper Mississippi River continues. The Upper Mississippi River-Illinois Waterway, according to a recently released study of the two systems, in 2005, 51.6 million tons of commercial cargo worth \$9.5 billion was transported on the Illinois Waterway.

⁴³ Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, p. 99.

⁴⁴ Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, pp. 100-102.

⁴⁵ Department of Public Works & Buildings, "132 Years of Public Service: The History and Duties of the Division of Waterways," (State of Illinois, 1955), p. 15.

Illinois Waterway traffic statistics are provided in the U.S. Army Corps of Engineers' Annual Reports. The information is presented in various ways throughout the 1930s. In 1931, the upbound traffic on the Illinois River (from La Salle to Grafton, IL) consisted of 128 steamers, 609 motor vessels, 21 sailing vessels, and 457 barges for a total of 1,215 vessels. The downbound traffic included 140 steamers, 515 motor vessels, 21 sailing vessels, and 400 barges for a total of 1,076 vessels. (USACE, *Annual Report*, Part II, 1932, p. 696.) By 1933, traffic had increased to a total of 2,140 upbound vessels at 341,760 tons, consisting of 50 steamers, 1,251 motor vessels, 772 barges, and 67 other types. Downbound traffic numbered 2,290 vessels at 344,249 tons, including 50 steamers, 1,282 motor vessels, 756 barges, and 202 other types. In 1934, the total numbers of vessels had declined but the tonnages increased, with upbound tonnage at 642,715 and downbound at 682,214. (USACE, *Annual Report*, Part II, 1934, p. 670 and Part II, 1935, p. 710.) In 1935, the statistics for the Illinois Waterway also included the Chicago Sanitary & Ship Canal and the Calumet-Sag Canal. The total tonnage was 1,361,280. On the South Branch of the Chicago River, 215,107 tons were carried. Total tonnage, including rafted traffic, was 1,584,428 tons worth \$48,710,394. (USACE, *Annual Report*, Part II, 1936, p. 747.) In 1936, 1,537,759 tons were transported on the Illinois Waterway and 507,805 tons were moved on the South Branch of the Chicago River. The total tonnage was 2,048,057, including rafted traffic, for a total value of \$54,725,585. (USACE, *Annual Report*, Part II, 1937, p. 781.) In 1937, 2,874,864 tons were transported on the Illinois Waterway and 698,329 tons on the South Branch of the Chicago River. The total tonnage, plus rafted traffic, equaled 3,575,299 tons worth \$65,604,398. (USACE, *Annual Report*, Part II, 1938, p. 803.) By 1938, the total tonnage on the Illinois Waterway (which included the Chicago Sanitary & Ship Canal, Calumet-Sag Canal, and South Branch of the Chicago River) was 4,446,493, including rafted traffic, at a total worth of \$109,008,794. (USACE, *Annual Report*, Part II, 1939, p. 863). From 1975-86, the amount of goods shipped on the waterway decreased from 48.5 million to 42.3 million. (Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," p. 103).

Together the two systems move 60 percent of corn exports and 45 percent of soybean exports, in addition to coal, chemicals and petroleum.⁴⁶

The Thomas J. O'Brien Lock and Control Works is significant as a component of the Illinois Waterway. The use of sector gates on the lock is also significant as an example of the Army Corps experimenting with new technology in an effort to reduce construction costs.

Part III. Sources of Information

A. Primary Sources

"500 Dedicate O'Brien Lock and Dam Today." *Chicago Daily Tribune*, October 20, 1958, p. 21.

"Calumet Lock and Dam Work is 13% Ahead." *Chicago Daily Tribune*, August 14, 1959, p. C7.

Committee on Engineering, Sanitary District of Chicago. "Calumet-Sag Canal. A Vital Necessity." May 25, 1925.

Corey, John B. Jr. "Calumet-Sag Navigation Project." *Journal of the Waterways and Harbors Division, Proceedings of the American Society of Civil Engineers* Paper 1643, WW3 (May 1958), pp. 1643-1 – 1643-11.

Getz, Anne. "Reveal Calumet Flood Plan." *Chicago Daily Tribune*, July 10, 1966, p. S1.

"Light Cofferdam Cuts Lock Cost." *Construction Methods and Equipment* 41, no. 6 (June 1959): pp. 109-113.

Record Group 77, U.S. Army Corps of Engineers, Chicago District. National Archives and Records Administration, Great Lakes Region-Chicago.

Santina, William J. and E.G. Hoffman, "Calumet River Lock, Calumet-Sag Project, Illinois." *Journal of the Illinois Waterways and Harbors Division, Proceedings of the American Society of Civil Engineers* Paper No. 1642, WW3 (May 1958), pp. 1642-1 -1642-20.

U.S. Army Corps of Engineers. "Calumet-Sag Channel, Il." Washington, DC: U.S. Government Printing Office, 1934.

⁴⁶ See Final Draft, "Re-Evaluation of the Recommended Plan: UMR-IWW System Navigation Study, Interim Report," issued March 2008, available at <http://www2.mvr.usace.army.mil/UMRS/NESP/> (accessed March 2009).

_____. *Annual Report of the Chief of Engineers, U.S. Army.* Washington, DC: Government Printing Office, 1959-60.

B. Secondary Sources

Larson, John W. *Those Army Engineers: A History of the Chicago District U.S. Army Corps of Engineers.* Chicago: U.S. Army Corps of Engineers, Chicago District, 1979.

Rathburn, Mary Yeater. American Resources Group, Ltd. "Architectural and Engineering Resources of the Illinois Waterway between 130th Street in Chicago and La Grange." Volume 1, prepared for the U.S. Army Corps of Engineers, Rock Island District, Rock Island, Illinois. October 1996.

_____. American Resources Group, Ltd. "Architectural and Engineering Resources of the Illinois Waterway between 130th Street in Chicago and La Grange." Volume 2, prepared for the U.S. Army Corps of Engineers, Rock Island District, Rock Island, Illinois. October 1996.

C. Likely Sources Not Yet Investigated

Research was conducted in the Army Corps of Engineers records (Record Group 77) at the National Archives and Records Administration, Great Lakes Region, Chicago, but time constraints prevented thorough research into all available records. Additional research may turn up more information on this site.

Research was conducted on site. A binder of photographs entitled "Calumet-Sag Navigation Project Thos. J. O'Brien Lock & Dam" and loose photographs documenting construction and repairs to the site were reviewed.

Appendix A: Images



Figure 1: Construction, no identification or date provided. Available at Thomas J. O'Brien Lock and Control Works.



Figure 2: Construction, no identification or date provided. Available at Thomas J. O'Brien Lock and Control Works.



Figure 3: Construction, no identification or date given. Available at Thomas J. O'Brien Lock and Control Works.



Figure 4: Construction, no identification or date given. Available at Thomas J. O'Brien Lock and Control Works.



Figure 5: Construction of control works, no identification or date given. Available at Thomas J. O'Brien Lock and Control Works.



Figure 6: Control Station, no date given. Available at Thomas J. O'Brien Lock and Control Works.